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(54) Foaming antibacterial liquid formulation for cleaning kitchen surfaces.

(57) Herein is disclosed a nonionic aqueous dishwashing liquid that has good foaming capability and antibacterial action. The liquid contains:

a) 0.5 to 15 weight percent of a quaternary disinfecting compound;
b) 0.5 to 20 weight percent of a C_{12}-C_{13} alcohol ethoxylate nonionic surfactant;
c) 0.5 to 20 weight percent of a C_{13}- C_{15} alcohol ethoxylate nonionic surfactant;
d) 0.55 to 20.0 weight percent lauryl dimethyl amine oxide nonionic surfactant;
e) 1.5 to 20.0 weight percent cocoamidopropyl betaine nonionic surfactant;
f) 0.5 to 20.0 weight percent cocodiethanol amide nonionic surfactant;
g) 1.0 to 20.0 weight percent cocamidopropyl hydroxyl sultaine; and
h) 0.2 to 2.0 weight percent disodium EDTA.

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This invention relates to formulations for manually washing dishes.

Light-duty liquid detergent formulations for kitchen surfaces are well known. Kitchen surfaces include counter tops, stove tops, dishes and any other hard surface commonly found in kitchen environments. The term "dishes" includes any utensils involved in food preparation or consumption. Kitchen surfaces, particularly dishes, must be washed free of food residues, greases, proteins, starches, gums, dyes, oils and burnt organic residues.

Most of the consumer accepted formulations in use include anionic synthetic surfactants with or without a nonionic surfactant. Many of such formulations contain a sulphonate-type anionic surfactant, for example, an alkylbenzene sulphonate or an alkane sulfonate, in conjunction with a sulphate or alkyl ether sulphate, or a nonionic surfactant, for example, an alcohol ethoxylate, an alkyl phenol ethoxylate, a mono- or diethanolamide or an amine oxide. The sulphonate material generally predominates.

It is the anionic surfactant that provides the typical high foaming (suds) characteristics generally associated with dish washing formulations. Foam (suds) is the cleaning efficacy signal relied on by consumers. Nonionic surfactants generally do not provide good foaming characteristics.

It is known from US-A-2,746,928 that it is not possible to mix anionic surface-active agents with quaternary ammonium germicides. The cationic quaternary ammonium germicide reacts with the anionic surface-active agent resulting in a reduction in germicidal and detergent activity.

Thus anionic surfactants are incompatible with cationic quaternary antimicrobial surfactants and non-ionic surfactants do not normally provide significant foaming capability to liquid formulations. Therefore current dish washing formulations can only mechanically eliminate bacteria from kitchen hard surfaces. They are not effective in killing or controlling the spread of germs throughout the kitchen environment. Thus dish washing liquids combining good foaming and antimicrobial activities are not available to the consumer.

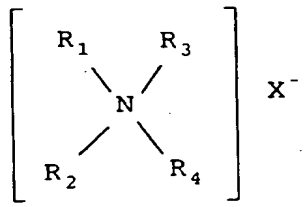
The present invention provides an aqueous disinfecting liquid formulation for cleaning hard surfaces, particularly dishes, in a kitchen environment; wherein said formulation is free of anionic surfactants and consisting essentially of:

a) 0.5 to 15 weight percent of a quaternary disinfecting compound;
b) 0.5 to 20 weight percent of a C_{12}-C_{13} alcohol ethoxylate nonionic surfactant;
c) 0.5 to 20 weight percent of a C_{13}- C_{15} alcohol ethoxylate nonionic surfactant;
d) 0.5 to 20.0 weight percent lauryl dimethyl amine oxide nonionic surfactant;
e) 1.5 to 20.0 weight percent cocoamidopropyl betaine nonionic surfactant;
f) 0.5 to 20.0 weight percent cocodiethanol amide nonionic surfactant;
g) 1.0 to 20.0 weight percent cocamidopropyl hydroxyl sultaine and
h) 0.2 to 2.0 weight percent disodium EDTA.

This formulation of this invention will control the presence and spread of bacteria on hard surfaces in the kitchen environment, especially dishes. This invention is a microbiological active quaternary ingredient homogeneously incorporated into a nonionic aqueous surfactant system. Unexpectedly the formulation has good flash foaming and residual foaming capability although no anionic surfactants are included.

Optional ingredients can include fragrances, dyes and stabilizers.

The purpose of the quaternary ammonium disinfectants is to kill on contact gram positive and gram negative organisms the organisms encountered in kitchen environments. Useful such disinfectants include BTC 8358 which is N- Alkyl (50% C_{14}, 40% C_{12}, and 10% C_{16}) dimethyl benzyl ammonium chloride. Other quaternary ammonium salt may be any of the well-known class of quaternary ammonium germicides characterized by the formula:



wherein at least one of the radicals R_1, R_2, R_3 and R_4 is a hydrophobic, aliphatic, aryl aliphatic, or aliphatic aryl radical of from 6 to 26 carbon atoms and the entire cation portion of the molecule has a molecular weight of at least 165. The hydrophobic radicals may be long-chain alkyl, long-chain alkoxy aryl, long-chain alkyl aryl, halogen-substituted long-chain alkyl aryl, long-chain alkyl phenoxy alkyl, aryl alkyl, and so forth,

in nature. The remaining radicals on the nitrogen atom other than the hydrophobic radicals are substituents of hydrocarbon structure usually containing a total of no more than 12 carbon atoms. The radical X in the above formula is any salt-forming anionic radical.

Suitable quaternary ammonium salts within the above description include the alkyl ammonium halides such as cetyl trimethyl ammonium bromide, alkyl aryl ammonium halides such as octadecyl dimethyl benzyl ammonium bromide, N-alkyl pyridinium halides such as N-cetyl pyridinium bromide, and the like. Other suitable types of quaternary ammonium salts include those in which the molecule contains either, amide or ester linkages such as octyl phenoxy ethoxy ethyl dimethyl benzyl ammonium chloride, N-(laurylcocoaminoformylmethyl) - pyridinium chloride, and so forth Other very effective types of quaternary ammonium germicides are those in which the hydrophobic radical is characterized by a substituted aromatic nucleus as in the case of lauryloxyphenyltrimethyl ammonium chloride, cetylaminophenyltrimethyl ammonium methosulfate, dodecylphenyltrimethyl ammonium methosulfate, dodecylbenzyltrimethyl ammonium chloride, chlorinated dodecylbenzyltrimethyl ammonium chloride, and the like.

Preferred quaternary ammonium germicides of the above general types are the long-chain alkyl dimethylbenzyl quaternary ammonium salts, the alkyl phenoxy alkoxy alkyl dimethyl benzyl quaternary ammonium salts, the N-(acylcocoaminoformylmethyl)pyridinium halides, the long-chain alkyl trimethyl ammonium halides, the long-chain alkyl benzyl dimethyl benzyl ammonium halides, and the long-chain alkyl benzyl diethyl ethanol ammonium halides in which the alkyl radical contains from 8-18 carbon atoms.

The mechanism of this nonionic system for cleaning standard food and kitchen soils is through emulsification of the soils. Current anionic light duty liquids solubilize most food soils. When soil is emulsified within a system, it will affect the type, density and amount of foam that can be generated. In general, emulsified fatty soils will reduce the amount of foam that can be generated as further cleaning takes place. Since anionic systems solubilize soils, the effect on the foam is not as great as with nonionic systems. Therefore, foam generated from anionic systems is of greater volume and more stable throughout the cleaning process.

In general, anionic surfactant systems such as those found in the current light duty liquids are classified as high foamers. Conversely, nonionic surfactant systems are classified as low foamers.

The challenge was to achieve disinfection activity while producing consumer acceptable foam using a nonionic and cationic surfactant combination. By careful selection and great experimentation, we have identified a surfactant mixture, expressed in Example 1, Table 1, that produce consumer acceptable foam comparable to commercial dish washing liquids using anionic detergents. The useful nonionic surfactants have various chain lengths and degrees of ethoxylation that allow the dish washing liquid to be effective on a wide range of food soils while providing good flash foam volume as well as moderate foam stability. This system provides the consumer with effective cleaning on, but not limited to, greasy food soils, fatty food soils, and oily food soils while maintaining disinfection.

Example 1

The unexpected foaming properties of the formulations of the invention are illustrated in this example. The foaming properties are due to the carefully balanced mix of nonionic surfactants. The formulation tested in this example contained the preferred concentration of ingredients listed in Table 1.

Table 1

	Preferred	Range
Ammonyx LO (30%)	5.00	0.5-20.0
Mirataine CBS (43%)	5.00	1.0-20.0
Neodol 25-12	5.00	0.5-20.0
Neodol 23-6.5	5.00	0.5-20.0
Mackam DZ (35%)	5.00	1.5-20.0
Mackamide C	5.00	0.5-20.0
BTC 8358 (80%)	1.40	0.5-15.0
Uvinul D-50	0.02	0.0- 0.1
Disodium EDTA	1.00	0.2- 2.0
BHT	0.10	0.0- 0.2
Fragrance	0.35	0.0- 0.5
Liquitint Patent Blue (1%)	0.08	0.0- 0.5
Water, DI	67.05	35.0-85.0

The formulation was prepared by adding the water, Ammonyx LO and Mirataine CBS to a beaker and mixing until uniform. Neodol 25-12 and Mackamide C were combined and then added to the beaker and mixed until uniform. Next Neodol 23-6.5 and UvindulD-50 were combined, added to the beaker and mixed until uniform. Finally Mackam DZ, BTC 8358 and EDTA were added to the beaker in sequence and mixed until uniform. The BHT and fragrance are premixed until uniform and then added to the beaker.

The chemical name and function of each ingredient in Table 1 is presented below in table 2.

Table 2

Trade Name	Chemical Name	Function
Ammonyx LO	Lauryl dimethyl amine oxide	nonionic surfactant
Neodol 25-12	C_{13}-C_{15} Alcohol ethoxylate	nonionic surfactant
Neodol 23-6.5	C_{12}-C_{13} Alcohol ethoxylate	nonionic surfactant
Mackam DZ	Cocoamidopropyl betaine	nonionic surfactant
Mirataine CBS	Cocamidopropyl hydroxyl sultaine	nonionic surfactant
Mackamide C	Cocodiethanol amide	nonionic surfactant
BTC 8358	n-alkyl dimethyl benzyl ammonium chloride	stabilizer
Disodium EDTA	Disodium ETA	chelator
BHT	Benzylhydroxyltoluene	stabilizer
DI water	deionized water	diluent

The good foaming capability is established by measuring foam height. Foam height was determined in unloaded and loaded water. Loaded refers to water to which oil has been added to simulate oils encountered during ordinary dishwashing. Unloaded refers to water to which no oil had been added.

Deionized water (512g at 120 °F) was mixed with 2g of the Table 1 preferred formulation in a 1500 mL beaker. The mixture was then beaten with a hand held egg beater mix for 50 revolutions or cycles. The foam height was measured at 15 minutes and 30 minutes intervals for the unloaded diluted dish washing liquid.

The same procedure was repeated for the loaded dish washing liquid by adding 2g of Crisco.

The commercial formulation to which the formulation of this invention was compared was an anionic based dishwashing liquid. The formulation of the invention had a foam height of 25.4mm for the loaded water and 50.8mm for the unloaded water. The commercial liquid had a foam height of 25.4mm for the loaded and 63.5mm for the unloaded. These results show that the formulations of the invention have good foaming characteristics without use of any anionic surfactants.

Example 2

The formulation in example 1 was tested for antimicrobial activity effectiveness against Staphylococcus aureus (ATCC 6538) and Salmonella choleraesuis (ATCC 6538) by AOAC *Use Dilution Method* as described in AOAC 15th Edition, 1990. The test was carried out at a dilution of 1 part formulation to 256 parts deionized water, at 5 minutes contact time and at different temperatures. This test is used microbiological activity for practical disinfection on hard surface carriers. In the test, a carrier is contaminated with test microorganisms through immersion in a broth culture. After the carrier is dried, it is immersed for 10 minutes with the individual formulation to be evaluated. The carrier, in a nutrient medium, is incubated for 48 hours. After 48 hours, the carrier is observed for growth of survivors. Ten to sixty carriers are examined for bacterial growth after contact with the test formulations. Test results ate expressed in terms of the number positive carriers out of the number of carriers being tested. Positive carriers are those having growth of the test organism. The results obtained are presented in Table 3.

Table 3

Test No.	Temp	No of Positive/Total Tested		
		Staph aureus	Sal.choleraesuis	
1	20 • C	20/30		-
2	50 • C		0/30	
3	45 • C		0/30	
4	40 • C		0/30	
5	40 • C	0/40		1/60
6	35 • C	2/30		3/60

The data of Table 3 illustrates the disinfection activity of the formulation of example 1 at 5 minutes contact time and 40 • C.

Examples 1 and 2 show that antibacterial dishwashing liquid formulation of the invention both cleans and kill bacteria present in the kitchen environment. This includes, but is not limited to dishes, counter tops, sink and dishwasher.

Claims

1. An aqueous disinfecting liquid formulation for cleaning hard surfaces in a kitchen environment; wherein the formulation is free of anionic surfactants and consisting essentially of:
   a) 0.5 to 15 weight percent of a quaternary disinfecting compound;
   b) 0.5 to 20 weight percent of a C_{12}-C_{13} alcohol ethoxylate nonionic surfactant;
   c) 0.5 to 20 weight percent of a C_{13}- C_{15} alcohol ethoxylate nonionic surfactant;
   d) 0.5 to 20.0 weight percent lauryl dimethyl amine oxide nonionic surfactant;
   e) 1.5 to 20.0 weight percent cocoamidopropyl betaine nonionic surfactant;
   f) 0.5 to 20.0 weight percent cocodiethanol amide nonionic surfactant;
   g) 1.0 to 20.0 weight percent cocamidopropyl hydroxyl sultaine and
   h) 0.2 to 2.0 weight percent disodium EDTA.

2. The formulation of claim 1 consisting essentially of
   a) 5 weight percent of alkyl dimethyl benzyl ammonium chloride;
   b) 5 weight percent of a C_{12}-C_{13} alcohol ethoxylate nonionic surfactant;
   c) 5 weight percent of a C_{13}- C_{15} alcohol ethoxylate nonionic surfactant;
   d) 5 to 20.0 weight percent lauryl dimethyl amine oxide nonionic surfactant;
   e) 5 weight percent cocoamidopropyl betaine nonionic surfactant;
   f) 5 weight percent cocodiethanol amide nonionic surfactant;
   g) 5 weight percent cocamidopropyl hydroxyl sultaine;
   h) 1 weight percent disodium EDTA.

3. The formulation of claim 1 or 2 wherein the quaternary disinfecting compound is alkyl (50% C^{14}, 40% C_{12} and 10% C_{16}) dimethyl benzyl ammonium chloride.

4. A method of manually washing hard surfaces in a kitchen environment, comprising the steps of:
   a) providing a disinfecting liquid according to any one of claims 1, 2 or 3;
   b) diluting the liquid with water; and
   c) contacting the surfaces with the diluted formulation.

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h) 0.2 to 2.0 weight percent disodium EDTA.

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EUROPEAN SEARCH REPORT

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EP 94 20 3078

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	GB-A-2 075 043 (J.J.FLANAGAN) * the whole document * ---	1-4	C11D1/835 C11D3/48 C11D3/00 C11D1/94 C11D3/33
A	GB-A-1 115 300 (PROCTER & GAMBLE CO.) * the whole document * ---	1-4	
A	EP-A-0 004 121 (PROCTER & GAMBLE CO.) * page 35; example xi * * claims * ---	1-4	
A	US-A-3 983 079 (G.L.SPADINI ET AL.) * the whole document * ---	1-4	
A	EP-A-0 152 194 (PROCTER & GAMBLE CO.) * claims * ---	1	
A	EP-A-0 107 118 (RICHARDSON-VICKS, INC) * claims * ---	1	
A	DATABASE WPI Week 9035, Derwent Publications Ltd., London, GB; AN 90-264444 & JP-A-2 184 609 (SANYO CHEM IND LTD) 19 July 1990 * abstract * -----	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

C11D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	10 August 1995	Pelli Wablat, B

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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